THE RAINFALL OF JAVA

By MARK JEFFERSON

The strong influence of relief on rainfall is well known. Hellmann's superb "Regenkarte von Deutschland"[1] renders Germany the best of all examples, with its 3,000 stations in a land of 209,000 square miles, just as South America is the worst, with its less than 500 stations in a continent of 7,000,000 square miles area. Dr. W. van Bemmelen, director of the meteorological observatory at Batavia, has actually outdone the German record in a recent work on the rainfall of the interesting island of Java,[2] citing 1,060 rain stations in an island of 50,000 square miles area. Of course Java's position close to the equator and the high relief of this island of volcanoes make this study one of especial interest. Dr. van Bemmelen refers to a map of rain distribution in Java that he published in 1908, with fewer stations and a shorter series of observations. He did not then venture to draw isohyetal lines—their complexity being obvious—but printed the rainfall numbers on the spot of observation upon a map showing the relief of the island. The result was not very expressive. To be sure one could manage to make out by studying this map the relation between the rainfall and the relief, but only by close and painstaking study. The total result of such study is precisely what would have been shown much better and apprehended more readily by isohyetal lines.

Now that the author has more stations and a lengthened series of observations he has attempted to draw isohyetals on a coarse scale for the whole island, with very interesting results. As the work is not likely to be generally accessible, the three principal maps are here reproduced. The atlas contains seven maps on the scale of 1:1,500,000, with the exception noted: (1) shaded relief, 1:1,000,000; (2) mean annual rainfall in tints with isohyetals for 1, 1½, 2, 3, 4, 5, 6, 7, and 8 *meters;* (3) mean *monthly* rainfall for July, August, and September in tints with isohyetals for 2½, 5, 10, 20, 30, 40, and 50 *centimeters;* (4) mean monthly rainfall for December, January, and February in the same tints; and (5), (6), and (7) the same for October-November, March-April, and May-June. The relief map further indicates the location of all rain stations and the boundaries of the Residencies.

Our Figure 1a shows the mean annual rainfall of Java for the extra-

[1] 1:1,800,000, Reimer, Berlin, 1906; also accompanying G. Hellmann: Die Niederschläge in den norddeutschen Stromgebieten, 3 vols., Reimer, Berlin, 1906.

[2] W. van Bemmelen: Uitkomsten der Regenwaarnemingen op Java. Uitgegeven in opdracht van het Gouvernement van Nederlandsch-Indië, xxiii and 173 pp., Batavia, 1914; with "Regenatlas," 7 plates, Topografische Inrichting, Batavia, 1915. See also the discussion by B. C. Wallis in the *Scottish Geogr. Mag.*, March, 1917, pp. 108-119.

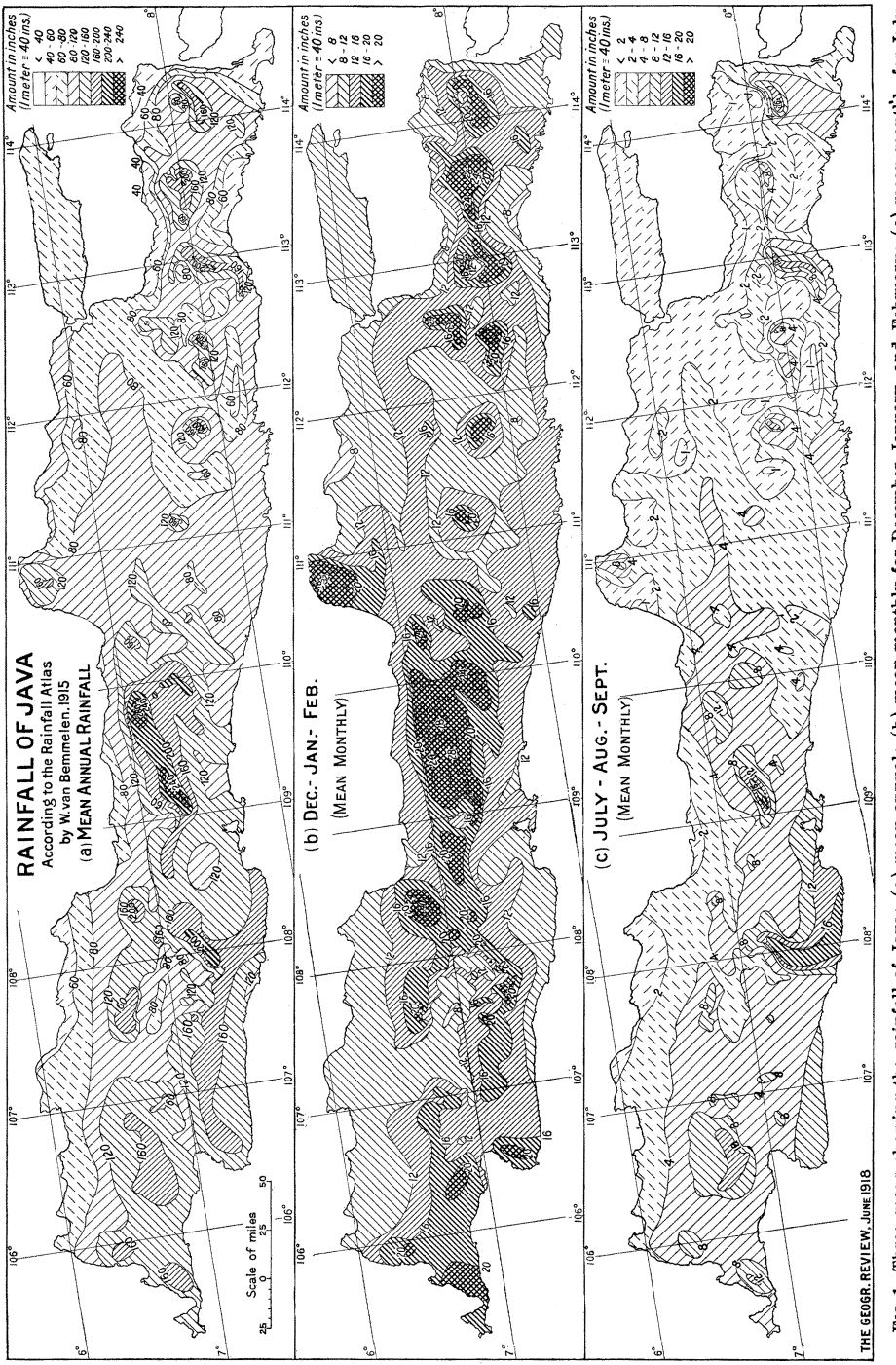

FIG. 1—Three maps showing the rainfall of Java: (a) mean annual; (b) mean monthly for December, January, and February; (c) mean monthly for July, August, and September. Scale, 1:11,500,000. Based respectively on Pls. II, III, and VI of van Bemmelen's rainfall atlas of Java, 1915 (for title see footnote 2).

ordinary interval of 40 inches, which we have put for van Bemmelen's meter, a coarser rain-grading than the reviewer ever encountered and quite appropriate to this land of giant relief and enormous rainfall. The maximum rainfall reported for one year is 332 inches (8,305 mm.) at Kranggan in Banjoemas Residency, among the west-central mountains, and the least is 35 inches (882 mm.) at Asembagoes in Besoeki Residency, at the northeast corner of the island. Decidedly Java is wet. Remember that Cherrapunji has but 474 inches and that the new coast record at Cape Anjeles in southern Chile hints at barely 500 inches for the southern Andes. The mean annual rainfall on the west slope of the mountain mass, G. Slamet (109° E.), is 320 inches.

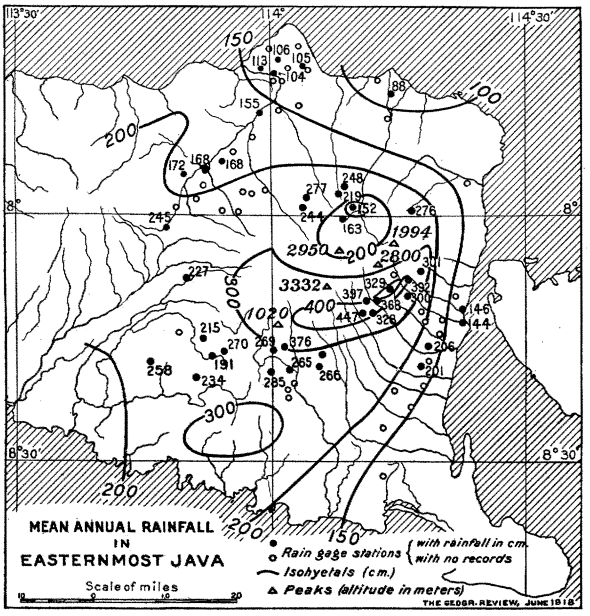

FIG. 2—Map showing in detail the mean annual rainfall at the eastern end of Java. Scale, 1:1,700,000. The rainfall amounts were plotted according to the text accompanying the atlas (see footnote 3) and the corresponding isohyetals were then drawn. These show that the isohyetals on the maps in the atlas are rigidly based on the records (cf. Fig. 1a).

Figure 1a shows more than 200 inches of rainfall along the whole of that massif from 109° to 110° E. Eight smaller mountain summits attain the same amount at points scattered along the eastern three-quarters of the island, as indicated by the patches of darker ruling. The heavier rainfalls can be seen to the southwest of the main heights, with striking rain shadows to the northeast. Very striking rain shadows are near 7° S. and 108° E. (80-inch patches) and near 8° S. and 114° E. (60-inch patch). On this map the whole distribution of rainfall *looks as if* the rain came from southwesterly winds blowing against the mountain slopes. This is also the case with the rain map for December, January, and February (Fig.1b). In July, August, and September (Fig. 1c) much less rain falls, and it looks rather as if it came on a southeasterly wind.

In neither case is there good agreement between the appearance of the map and the prevalent winds, which would seem to indicate that the rain falls from exceptional winds rather than from the prevalent ones, as it does in most parts of the United States and in many other parts of the world.

Our Figure 2, based on the text,[3] gives the actual figures used in drawing the isohyetals in Besoeki Residency among mountain masses ranging from 1,020 to 3,332 meters and seems fully to justify Dr. van Bemmelen's isohyetals. The complexity of these Java lines of equal rainfall contrasts admirably with the smooth ones of South America, where advancing knowledge has yet to put many a crook in the lines. The reason for using mean *monthly* instead of quarterly values of rainfall in the seasonal maps is that the seasons here made use of are of unequal length—two, three, and four months. The text contains abundant tables and discussions in English as well as Dutch.

[3] Pp. 73, 75, 77, 79, upper half.